REMARKS

The examiner indicated that the title of the invention is not descriptive and suggested a new title. The title has been changed as suggested. In addition, the abstract was objected to because the steps of the claimed process were not included. The abstract has been amended to include the steps. No new matter was added. The provisional allowance of claims 5-7 is noted with appreciation. Please note that there have been no substantive amendments to the claims.

The present invention as claimed, is a unique method of manufacturing low-voltage dry electroactive polymeric synthetic muscles for use as sensors, transducers and actuators. The novelty of the present invention is corroborated by the discussion of the state of the art in the Background Art section of the patent application. The unique method of manufacturing of the low-voltage dry electroactive polymeric sensors, transducers, and actuators also uses mixing, dry casting and near-boundary particulate loading schemes which is also novel as described in the Background Art section of the patent application.

Claims 1, 3, and 4 were rejected under 35 USC § 102(b) as being anticipated by Kojima, et al. Kojima describes a solid electrolytic capacitor and the method to manufacture the same. This rejection is vigorously traversed. Kojima teaches packaging a valve metal (element 12 in Fig. 1) with dielectric oxide layer (14 in Fig 1), a conductive layer (16) and conductive polymers (18), carbon layer (20) and a silver paint layer 22, etc., to create a capacitor (cols. 3 &. 4). On top of that, the whole assembly has to be in a support electrolyte, which is in liquid form (col. 4 line 51, col. 13, line 28, col. 14, lines 1-10). It is a wet process (col. 4 line 68) and in general water is used (col. 5, lines 22-38), phosphoric acid is also used (col. 5 line 47).

It appears that the Examiner has confused electrolytes and conductive polymers with polyelectrolytes, which are polymer electrolytes or ionic polymers, and in that sense completely different substances. For example, polyelectrolytes are not electrical conductors like conductive polymers. As an example, polyelectrolytes are ionic polymers that completely break up into cations and a poly anion (a big multi nodal poly ion of negatively charged network), which neither electrolytes such as table salt NaCl (Na+, Cl-) nor conductive polymers such as polyaniline are capable of doing. Please refer to the attached affidavit of Dr. Shahinpoor.

In the office action the Examiner makes the conclusory statement that "Kojima, et al., disclose a method of fabricating a dry electroactive polymeric synthetic muscle...". There are three errors in this statement. First of all, as previously indicated, Kojima discloses a method of manufacturing a capacitor using a conductive poylmer not a dry electroactive polymeric material as specifically claimed. Secondly, the making of the capacitor of Kojima is a "wet" process (col. 4 line 68) and not a dry process as specifically called for in the present claims. Finally, Kojima discusses manufacturing a capacitor not a synthetic muscle. Next, the Examiner indicated that Kojima teaches the step of "providing a polyelectrolyte material (such as a member conductive polymer film 18, Fig. 1)". In reading through the entire Kojima patent, the words "polyelectrolyte or synthetic muscle" do not appear. Additionally, the Kojima patent does not imply the use or description of a "polyelectrolyte, ionic polymers or synthetic muscle". As previously argued and corroborated in the affidavit of Dr. Shahinpoor, a conductive polymer is not the same as a polyelectrolyte or an ionic polymer, as defined in the specification. The specification distinguishes conductive polymers and ionic polymers from poly electrolytes on page 2, lines 21-28, page 3, lines 1-14, page 4, lines 20-28. References to polyelectrolytes are given in page 5, lines 1-28, page 6, lines 1-4, page 11, line 26.

These are totally different materials with different attributes and a person skilled in the art would not equate a polymer film with a polyelectrolyte. (See the affidavit of Dr. Shahinpoor). The Examiner then indicates that Kojima discloses the step of "mixing the polyelectrolyte material with a conductive material (see col. 4, lines 15-43)" and also the step of "affixing at least two electrodes (16, 20, Fig.1) to the polyelectrolyte material and conductive material". As previously indicated, Kojima does not discuss or imply a polyelectrolyte, thus this conclusion by the Examiner is erroneous. Thus, independent claim 1 is allowable over the prior art.

Claims 3 and 4 are dependent claims and due to the allowability of independent claim 1, these claims are also allowable. Further, Kojima does not discuss applying heat and mixing a dry polyelectrolyte with dry conductive material and applying pressure (the Examiner has confused electrolytes with polyelectrolytes which are totally different; See affidavit of Dr. Shahinpoor).

Claims 2, 8, and 10-12 were rejected under 35 USC § 103(a) as being unpatentable over Kojima, et al., in view of Burgess. Kojima was extensively discussed in the previous section, and the discussion is incorporated in this section has if fully set forth. Then the Examiner starts on page 4 to cite Burgess in combination with Kojima to reject claims 2, 8, and 10-12. Burgess describes a tactile sensing transducer for converting tactile pressure into an electrical signal. Burgess (col. 4 lines 26-29) discusses a process of making a conductive elastomer by a conductive filler material (old technology of dispersing a metallic or graphite powder phase inside a rubber like material to make it conductive deformable (elastic, rubber) and deforming it to cause changes in conductivity to measure pressure (tactile sensing)). In the present patent application, the finely divided particles in PEO are only to create a surface electrode and not to make the entire Polyethylene oxide (PEO) conductive, as described in Burgess.

Thus the rejection of claim 2 on this basis was in error. The Examiner rejected claim 8 based on Burgess by stating that the prior art patent teaches interlocking particles in col. 1, lines 50-64. Burgess, at the cited column and line number does not teach or imply "affixing at least two electrodes comprises physical loading and interlocking primary electrically conducting particles with smaller electrically conducting particles within the polyelectrolyte material". Further, Burgess is limited to tactile sensing while the present invention is for sensing and actuation. Burgess is also limited, because for tactile sensing, an electric potential has to be applied first to the elastomer (items 51 and 51 in Fig. 1) so that the pressure on the metal-filled elastomer causes deformation of the elastomer which changes its resistance and creates a signal change in current passing through it. The sensing capability in the present invention is inherent of the material and is self-powered and no outside or imposed electric potential or voltage is needed to make it act like a sensor. In rejecting claim 9, the Examiner cites Meisel in combination with Kojima. Again the Examiner has made an obvious mistake by claiming that Meisel discloses a polyelectrolyte material, which is a member of polyethylene oxide (see col. 5 line 50-53 of Meisel). However, Meisel in col. 5, lines 50-53, does not discuss polyethylene oxide but polyethylene, which is not a polyelectrolyte and is just a rubber like inactive material. The Examiner has confused the substantially different substances polyethylene oxide (PEO) which is a polyelectrolyte, with polyethylene (PE) which is not correct. Thus, the rejected dependent claims are allowable over the prior art and they are also allowable due to the allowability of the independent claim.

Having responded to each and every objection and rejection raised by the Examiner, it is believed that the patent application is now in condition for allowance, and such allowance is respectfully requested. If the Examiner has any questions or suggestions for expediting an allowance in this matter, the Examiner is invited to call the undersigned collect.

The Commissioner is authorized to charge any fees or credit any overpayment under 37 CFR §§ 1.16 and 1.17 which may be required during the entire pendency of the application to Deposit Account No. 01-2335.

Respectfully submitted,

Dated: August 5, 2004

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